



Technology Evaluation for Environmental Risk Mitigation Principal Center

Laser Coating Removal System Project for Ground Support Equipment

POC: Matthew Rothgeb, (321-867-8476) matthew.j.rothgeb@nasa.gov
Russell. McLaughlin, (321-867-3351) russell.l.mclaughlin@nasa.gov
Wade Olsen, (321-867-8467) wade.l.olsen@nasa.gov

Background

Several de-painting activities performed at NASA Kennedy Space Center (KSC) and other Centers are difficult to perform properly without damaging equipment in the process. Additionally, currently used de-painting technologies utilize hazardous chemicals and/or produce great volumes of hazardous waste that must be disposed of at great cost to NASA. In an effort to identify user-friendly, low-hazard methods of accomplishing de-painting activities at the shop or depot level, the Joint Group on Pollution Prevention identified lasers as a viable means to accomplishing these activities. Previously in the history of laser de-painting, the technology was not viable because of the size and design of laser systems. It was discovered that Europe had developed several types of portable, hand-held laser units for use in monument re-surfacing and cleaning. These technologies were researched for use in DoD aircraft depots for paint removal in small area applications. NASA owns a variety of aircraft and also operates many pieces of ground service equipment that could benefit from a de-painting technology that is light, portable, produces little to no hazardous waste and depending on the type and setup, requires little to no personal protection equipment while in use. Several NASA groups have shown interest in researching where these and other similar systems could be used in aircraft depot and ground service equipment and facilities operations.

Objective

The follow-on to the Joint Group on Pollution Prevention Portable Laser Coating Removal System project is to demonstrate one or more portable laser technologies for use in several areas within NASA. Initially, the first area is space-shuttle operations, where current methods of paint removal have been found to cause damage and contamination in the surrounding thermal protection system when shuttle tiles are being replaced after flight. However, after securing funding and scoping the stakeholders for areas of interest outside of flight equipment, it was decided to move forward with testing for use on Ground Support Equipment first. NASA funding was sought for an Orbiter project using the Portable Laser Coating Removal System, but was not secured. However, the Aging Vehicle program did grant some funding for preliminary analysis of this system for use on Orbiter. This is now a separate project that is co-coordinated by NASA and Boeing. Another area of interest to NASA stakeholders that may be addressed as the project develops would be to demonstrate the technology for use on NASA aircraft in depot operations (most of this has already been demonstrated during the Joint Group on Pollution Prevention study).

Period of Performance

- August 2005 to May 2009

Stakeholders

Kennedy Space Center, Glenn Research Center, Stennis Space Center and Wallops Flight Facility. Intercontinental Ballistic Missile plans to participate as well. Opportunities exist and will be explored with other NASA Centers and the U.S. Coast Guard for marine applications.

Benefits

- Reduction of hazardous waste streams in de-painting operations;
- Reduction of risk to workers of exposure to hazardous paint strippers;
- Reduction of time required for non-destructive evaluation of weld-lines;
- Reduction of depot time for aircraft in small area de-painting and re-painting; and
- Reduction of down-time for launch structures in-between launch cycles.

Document Status

- Completed field test plan for KSC – November 2006
- Completed field test plan for GRC – November 2005
- Completed final report - April 2008
- International Traffic in Arms Regulations approval of final report – December 2008.

Milestones

- Demonstration of portable laser technology on a variety of Orbiter, aircraft and structural substrates at Wright-Patterson Air Force Base for one-week in August 2004.

- Demonstration of portable laser technology at Glenn Research Center on a variety of equipment and on an outdoor-section of a decommissioned wind tunnel in October 2005.
- Demonstration of portable laser technology at KSC occurred over five weeks beginning in October 2006.
- Scanning Electron Microscope images and high-resolution magnification of samples, including cross-section views of samples showed a thin re-melt layer of aluminum and steel on the surface of stripped substrates. NASA and the Air Force are looking into any future testing that this discovery may require to determine if damage is critical for aerospace applications. – October 2007
- Identified the presence of a re-melt layer on substrates, performed tests to determine if it negatively affected the substrates. November 2007 – February 2008
- Boeing sent several test-panels to Hill Air Force Base for exposure to 500 Watt Laser to further characterize re-melt layer and any associated deleterious effects it has on substrate characteristics.
- All originally planned field-tests were completed by February 2008.
- Preliminary results showed the technology holds promise for small-scale depainting, corrosion removal, non destructive evaluation of weld lines, etc. February 2008.
- Corrosion analysis of steel and aluminum on the beach at KSC has determined that the use of lasers does not cause an increased rate of corrosion on substrates that have been stripped with the technology. February 2008
- Technology tested in May 2008 at Boeing Huntington Beach's facility for use on titanium surfaces.

Near-Term Goals

- Follow up on stakeholder interest in the laser technology, not only for the applications demonstrated but for potential new applications as well (remediation of lead based paint on structures, confined space small scale stripping in missile silos, non destructive evaluation, corrosion removal on Mobile Launcher Platform & Crawler, Air Force Space Command launch structures, etc).

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